Discussion Topics and Points

Carl G. Thelander
BioResource Consultants

California Energy Commission Meeting
21 September 2005

○ I am absolutely confident in our methods, the quality of the data we collected, the validity of the statistical analyses we subjected them to, and the results and recommendations they provided.

○ We achieved the CEC research objective, i.e. to identify possible methods to reduce bird kills in the APWRA.

○ If the Commission has ANY doubts about the report or its findings, I respectfully request that they withhold any opinions until after the CEC either conducts its own impartial peer review process that relies on independent and qualified scientists/experts, or until after completion of the publication peer-review process (National Academy of Sciences standards) that is underway as we publish our results in professional scientific journals.

○ I respectfully request that the following passage be removed from the draft and that it not appear in the final version.

> The Energy Commission believes that the earlier research, *Developing Methods to Reduce Bird Mortality in the Altamont Pass Wind Resource Area*, represents an important initial effort to craft a methodology to prescribe mitigation measures, but that it should not be misused to form the sole basis for such mitigation measures. Inadequate access to certain turbines, time lapses between surveys, length of survey period, and various extrapolation techniques deprive it of the evidentiary value which the Energy Commission would require as the basis for mitigation measures in a power plant siting case. The scientific value of ongoing Energy Commission research into avian mortality prevention should not be jeopardized by misapplication of what are essentially experimental results.

○ The Commission's premature rejection of our report has unfairly harmed and compromised my (and my firm's) professional reputation and that of my colleagues.

> We (CalWEA) are also gratified that the Commission has formally recognized the serious flaws in the [December 2004 report], whose avian mortality figures have been widely quoted in the press and which formed the basis for the staff recommendations that the draft IEPR rejected. The Commission stated that the report's numerous flaws "deprive it of the evidentiary value which the Energy Commission would require as the basis for mitigation measures in a power plant siting case." This same flawed report is being used in litigation against Altamont project owners and was relied upon by the Attorney General's office in an alarming letter to Alameda County officials. (Alameda County is in the process of developing conditions for the extension of conditional use permits for the wind projects in its jurisdiction. It is expected to take action on September 22.)

○ Our results are association models. They are not experimental, but the widespread testing of methods we recommend in our report will be experimental. Experimenting with kill reduction techniques to reject/modify some, and to universally apply others, by using the principals of

adaptive management is the approach preferred by the owners. Our CEC-funded research provided the basis for moving forward with that approach.

○ Results of our mortality estimates are not experimental. They are estimates derived using a CONSERVATIVE set of analytical assumptions and calculations that, we believe, best fit the conditions present in the Altamont region.

○ The research was completed in **two phases** with NREL funding (Phase 1) being followed by CEC funding (Phase 2).

> Phase 1 funded by NREL (1998-2001).
> Phase 1 focused first on quantifying the magnitude of the problem by determining bird **mortality** (rate per unit time) per species. Over 30 species were found dead, but many in numbers too small to produce reliable or meaningful estimates for comparisons between wind farms and other typical uses of such estimates.
> Phase 1 quantified bird use with respect to turbine types and perching behavior mainly.
> Phase 1 was limited to 28% of the turbines, but NREL sought APWRA-wide characterizations and solutions.
> Phase 1 report entitled **"Bird Mortality in the Altamont Pass Wind Resource Area: March 1998 – September 2001"** peer reviewed and distributed by NREL.

○ Funding for NREL Avian Program discontinued by DOE.

○ Phase 2 funded by CEC 2002 – 2003 field work
> In Phase 2, CEC shifted the focus from continued emphasis on quantifying bird kills (refining mortality estimates) to developing methods to reduce kills using association models based on individual **fatalities** and the conditions associated with where they were killed (turbine type, location, physiography, prey factors, etc.).
> In Phase 2, developing association models required finding carcasses killed by turbines that more broadly represented all APWRA turbines and settings.
> Phase 2 report entitled "**Developing Methods to Reduce Bird Mortality in the Altamont Pass Wind Resource Area**" reviewed widely and distributed by the CEC.

○ Phase 1 emphasized mortality estimates: Phase 2 emphasized fatality association models. There is a **significant** difference between these. Mortality is a rate. Fatality is the actual number of birds found dead. Fatality was used in the association models.

○ Phase 1 Data Set mortality estimates are most reliable of the two data sets, but they fail at being representative of the entire APWRA (28% of turbines only). Phase 2 Data Set differs somewhat from previous data set, but not significantly. Our CEC report copiously documents the differences and how we compensated for the statistical differences. The result of combining the two data sets is a weighted average estimate for mortality for all fatalities found during Phases 1 and 2. Weighted averages are entirely defensible and very useful.
Adding Data Set 2 to Data Set 1 lead to more robust mortality estimates. Extrapolating from either data set alone results in some overestimates and some underestimates. Golden eagles would be underestimated if we reported only Set 1 data.

○ Useful insights came from Data Set 1 and Data Set 2: Despite the reduced search effort and duration for Data Set 2, we found 4 times the number of golden eagles than were found for Data Set 1. This is significant given that those golden eagles fatalities contributed a great deal to our association models in terms of better understanding the differences in the Altamont landscape. Similar useful insights were extracted. I submit that it was essential that Data Set 2 be included in our mortality estimates, but we also gave cautionary disclaimers as to the interpretation limitations of doing so.

○ We elected to NOT apply more aggressive correction factors to our mortality estimates that were available to use from other wind farm reports. These all would have INCREASED the maximum values for the ranges we calculated while not improving their overall reliability.

○ It is a widely accepted standard for mortality estimates to be reported as ranges (minimum and maximum estimates) for each bird species found. These data can be subseted and pooled any number of ways, depending on your research goals. The wider the range of these values per species, the less reliable the estimate. Initially we did not intend to report estimates for all birds, but the Altamont Wind Operators and the FWS requested that we do so in a series of meetings that were held during the research period. Doing so required applying a relatively complex set of assumptions and correction factors (see Staff Comments to Reviewers for details). Still, we did not calculate ranges of estimates for species represented by only a single fatality.

We provided readers with every aspect of the data – raw fatality figures, mortality estimates with different adjustments – to honestly inform readers of the nature of the reliability of the estimates we provided. We provide the data and the means for any informed reader to develop their own mortality estimates using their own adjustment factors, etc. Our approach encourages meta analyses of our data to compare with other data from other wind farms.

○ USFWS, CDFG, CEC, and others requested that our research generally address raptors and that we mainly address only 4 raptor species: Golden Eagles, Red-tailed Hawks, American Kestrels, and Burrowing Owls. We followed that direction. Regardless, reviewers have focused on our passerine (small bird) results as being indicative of 'flaws' in the entire data set. We knew that our Phase 2 results would provide estimates with lower reliability for the small bird estimates, and to some extent for the larger birds, and we emphasized that disclaimer in our report.

○ Efficacy of correction factors applied to mortality estimates: We provided a enormous amount of detail in our report and in staff's responses to comments about our application of standard correction factors when calculating mortality estimates. We noted what factors we used and to what extent and why such application resulted in conservative estimates. We provided all data necessary for a reader familiar with these types of data to determine raw mortality (no correction factors) and various subsequent estimates using a sequence of standard and entirely defensible bias factors. It is standard practice (required by National Wind Coordinating Committee Guidelines) to apply these factors in studies relating to finding and estimating bird kills for wind farm fatality studies and for bird electrocution studies. These correction factors are applied to take into account birds not detected due to searcher bias and scavenging.

○ We elected to NOT apply additional correction factors like 'Crippling Bias' that is often applied. We were entirely justified to do so, based on our field observations and the number of wounded birds picked up by turbine owner personnel, but we elected to not apply it. Doing so would have increased the upper limits of the ranges of our estimates. Also, we don't believe that a single correction value would apply to all species, so it was problematic as to how best to apply such a factor(s).

○ **Average** Survey Intervals vary from 50 – 90 days. As with other correction factors used to develop mortality estimates, we pointed out the differences between our data sets in terms of our survey schedule and we applied defensible adjustments (detection, scavenging, and >50 meter finds) to each of the two data sets when we developed our estimates. Ninety days is not excessive by any standard for surveys that emphasize finding large birds in grasslands such as golden eagles and red-tailed hawks. Ninety days has been used in other avian – wind studies, for example, in the Tehachapi studies conducted by Dick Anderson et al. (WEST, Inc.), which is also presented in an NREL published peer reviewed report.

○ There is no standard sampling schedule (i.e., period between survey events) for bird kill surveys. The study design depends on the objectives, any statistical power goals, budget constraints, and other factors. Local conditions also apply, like vegetation coverage and visibility (i.e., APWRA is a treeless grassland that is overgrazed). We designed and conducted a highly credible research project, one that is likely to set a new standard for monitoring efforts at wind farms.

○ There are differences in detecting our target species (e.g., big birds like golden eagles and red-tailed hawks) versus detecting smaller birds. Larger birds remain highly visible and detectable for very longer periods of time than do smaller birds. Some of the eagles and hawks that we left in place where they died (and flagged) remained detectable for greater than 120 days.

Our research objectives directed us to emphasize larger bird issues. We acknowledge that the results for our targeted large raptor species (see above), for which there were hundreds of recorded fatalities, are generally more reliable than were our data for smaller birds such as passerines (that is why the range in mortality estimates are larger for small birds). Our fatality associations focused only on these large birds. Reviewers now claim that because the results for ALL species are not equally reliable that all of the results should be deemed unreliable. That conclusion is false.

○ We recommend 3 years of fatality searches to get reliable mortality estimates but then we rely on shorter survey efforts ourselves.

We still view our estimates as being reliable and useful to our research goal, but they would have been more reliable, and probably could have reached maximum achievable reliability (certainty), after at least 3 years of intensive. The criticism that we used data from 3 months of surveys at the Phase 2 turbines is misleading because our mortality estimates were based on a pooling of all of the data (4 years) to derive **a weighted average**. Data from the 3- month survey were,

however, very useful in developing the fatality associations we needed for our models, which was the primary focus of our Phase 2 research.

We dedicated Appendix A to explaining that if a high degree of sensitivity is needed to detect subtle changes, such as will be needed for experiments testing kill reduction techniques. If mortality estimates are used in those experiments, then at least 3 years of data are needed to achieve maximum reliability in those estimates.

- NONE of our research objectives to identify methods to reduce birds kills requires that we conduct 3 years of fatality searches (i.e., achieve near-certainty).

Our objectives depended on the frequency of kills to build a suitable sample size for our association models. Finding more kills increased our sample size and usually the geographic representation of our sample throughout the APWRA. It made our association models more robust. Future fatality data can be combined with our data to make the models increasingly robust over time. We achieved an adequate sample size of kills to support the kill reduction methods we identified and recommended. Yes, we could report more reliable (less uncertain) minimum-maximum values for each of our mortality estimates had we conducted 3 years of mortality searches, but that was not our objective. But most importantly, we in no way dependent on such refined estimates to achieve our research goals. We properly anticipated this and proceeded to use our association model approach in large part because it did NOT rely on the precision of any mortality estimates

When conducting experiments in the APWRA that test our recommended methods at reducing kills, which is the proposed adaptive management approach, very precise and statistically sensitive mortality estimates will likely be needed to evaluate their effectiveness. That is why we cautioned the proponents of adaptive management from relying on mortality estimates as their statistical tool of choice, unless they commit to 3 or more years of fatality monitoring and use mortality as their preferred metric..

We recommend instead that they continue with our association model approach to avoid the pitfalls of only relying on mortality estimates. As stated above, we dedicated an entire appendix (see Appendix A) to this important topic in order for future researchers and regulators to fully appreciate the difficulties of ever being able to provide robust mortality estimates (i.e., with relatively narrow minimum-maximum ranges).

- Feather spots were used to verify turbine fatalities.

We used feather spots as indicators of likely turbine kills, as do ALL other researchers monitoring wind turbines for bird kills. Large birds (mostly raptors) leave much more than just feather spots. Relying on feather spots is a technique usually necessary to detect small birds that often leave few remains after being hit by a rotating turbine blade. Admittedly, professional judgment and surveyor training is important, especially if the study objective is oriented toward estimating mortality for small birds with a high degree of certainty. Our research was not oriented in that direction. We were focused on raptors mainly.

The scientific community has not determined that the feather spot technique should be removed from the standard guidelines. Other studies have relied on feather spots to a much larger degree. For example, WEST, Inc. reported **42%** of their fatalities at Nine Canyon as based on feather spots. Dick Anderson et al. in a CEC-sponsered study reported **55%** of the fatalities being based on feather spot detections. We relied on only 22% of our fatalities as being determined by feathers spots.

- Background mortality not addressed adequately.

No doubt some birds die of natural causes in the APWRA, and some possibly die near operating wind turbines. Given the power of our sample sizes, especially for raptors, it could not substantially shifted the means of our mortality estimates.

Two independent studies that attempted to determine background mortality decided to discontinue their efforts to establish a reasonable correction factor for background mortality. They cited as reasons finding too few fatalities, the negligible effect this would have on the overall results, and the costs associated with doing so.

We are confident that adding a correction factor for background mortality would not have shifted our estimates appreciably, if at all. Other 'natural factors' may be out there that we know nothing about that may also be affecting our results to some unknown degree. That is why we call them estimates. Regardless, we defend our choice to ignore background mortality while we also fully defend that we met our research objectives without incorporating it. We did not rely on our mortality estimates to develop our association models, which were the basis for nearly all of our recommendations on how to reduce bird kills in the APWRA.

- I have read every publicly available review comment pertaining to our report. Many of the review comments were based on misinterpretations of our data/results/tables/figures.

- Nearly every comment regarding statistical matters, including mortality estimate calculations, sampling efforts, feather spots, correction factors, and the rest <u>all</u> focused on the margins of our data presentation and our analyses, not on their core statistics.

- I have no doubt that additional, independent, and objective peer reviews will endorse our analytical and statistical approach and the findings/recommendations that resulted from them. We will be publishing our results in professional journals in the very near future.

- I conclude by restating that I welcome any professional, independent peer review process by experts on the topics in question. Until that time, I stand in support of our report, and I will continue to vigorously advocate for the Commission and Staff to do the same.